

Deep venous thrombosis and pulmonary embolism in joint replacement surgery

Even though joint replacement surgery is an effective procedure and in expert hands yields a low complication rate, deep venous thrombosis and pulmonary embolism are still a major concern for all surgeons who perform joint replacement surgery.

We prepared this text so that you can understand, in simple terms, that the risk of deep venous thrombosis and pulmonary embolism **always exists** in **all** patients who undergo joint replacement surgery, even though precautionary measures have been taken by the surgeon.

Causes:

Blood clotting is a normal physiological process in our body that constantly takes place thanks to finely tuned chemical reactions. (These chemical reactions are termed “coagulation cascade”).

The coagulation cascade is a true defense mechanism that is automatically triggered under different circumstances. For example: when we accidentally cut the tip of our finger with a razor blade, or during any kind of surgery this coagulation cascade stops the bleeding in a natural manner by forming a blood clot (or thrombus).

This coagulation cascade is so complex that it has to be working in constant equilibrium. If the coagulation cascade didn't exist or if it worked deficiently the person could bleed profusely with minor cuts or he/she could bleed spontaneously (we see this kind of problem in patients who suffer from haemophilia). On the other hand if the system works by excessively forming clots, these clots will be constantly blocking blood flow to the heart, the lungs and from the legs. This is commonly known as a hypercoagulability state (or blood thickening) and is commonly seen in genetic disorders or severe infections.

What we are really trying to say is that blood clotting is not at all bad - the problem arises when the blood clots are generated in an excessive manner compromising the general venous blood flow.

There are several factors that influence and predispose the excessive formation of blood clots inside our veins, the most important ones are:

- **Blood flow stasis:** This happens when you stay for a very long period of time in one position. It can be sitting or lying down with little or no movement such as on long air flights, surgery or a long hospital stay while bedridden.
- **Hypercoagulability states:** This is known as blood thickening, and it secondary to genetic predisposition, or acquired states such as dehydration, severe infection or major surgery (hip and knee replacement).

- **Damage to the vascular walls:** All damage to the microvascular walls triggers the coagulation cascade and this microtrauma to the vascular walls can readily be seen in major surgery to the lower limbs including joint replacement.

Joint Replacement Surgery affects all of the three predisposing factors generating the development of abnormal clots resulting in deep venous thrombosis and pulmonary embolism, but there are also many existing factors wherein the patient can increase the risk and incidence of this problem:

Age over 60

Varicose veins

Cancer

History of previous deep venous thrombosis or pulmonary embolism

Smoking

Use of Estrogens

Use of Steroids

Obesity

Etc.

Consequences:

Normally, the production of blood clot formations is gradually discontinued by our body thanks to self-regulatory chemicals in our blood stream. However, if this blood clot formation cascade cannot be halted it can result in two very serious conditions:

1. **Deep venous thrombosis:** If the blood clot partially or completely blocks blood flow in one or more of the deep veins in our lower limbs, thus preventing blood from the lower extremities to return to the heart and general circulation, this vein will start to dilate, fluids will begin to seep into the surrounding tissues resulting in serious swelling of the lower limb and much pain. The massive clot can break the venous valves resulting in chronic venous insufficiency, swelling, pain and limping.
2. **Pulmonary embolism:** Part of the blood clot that blocks the deep venous system can rupture and travel back to the heart and finally lodge in the pulmonary circulation causing severe respiratory and cardiac alterations. This can be so severe that the patient could experience sudden death as a consequence of severe cardiac or respiratory insufficiency. It can also lead to chronic pulmonary hypertension.

Prevention:

This is known as thromboprophylaxis. Medical literature states that all patients undergoing hip or knee replacement have an 80% chance of developing deep venous thrombosis if they don't receive proper preventive measures, while 10 to 20% of patients who develop deep venous thrombosis are at risk of developing pulmonary embolism. Because the risk of developing deep venous thrombosis and pulmonary embolism is so high in patients undergoing hip and knee replacement surgery, **ALL** patients are suitable candidates for preventive measures and thromboprophylaxis.

All measures used in preventing deep venous thrombosis **diminish** the risk of presenting this serious complication but such measures cannot completely **abolish** these risks. This means that a patient who has received all proper prophylactic measures previous to undergoing hip or knee replacement surgery will still be at risk of developing deep venous thrombosis and pulmonary embolism; nonetheless, the risk is much smaller one.

Preventive measures include mechanical or pharmacological means or a combination of both:

Mechanical means:

1. **Prompt mobilization after surgery:** This is most likely one of the most important measures to prevent deep venous thrombosis and pulmonary embolism. Your doctor will show you, instruct you and encourage you to move in your bed starting a few hours after surgery. He/she will insist that you change position frequently in your bed and he/she will show you the proper postoperative exercises that you will be doing as soon as the anaesthesia wears off. With these measures we are working to prevent your blood from pooling inside the veins of your legs.
2. **Use of antithrombotic stockings:** These stockings might be a bit uncomfortable in the beginning but you will eventually get used to them. They will be worn for at least one month. Each patient is different and your doctor will let you know which type of stockings are best for you and for how long you'll be using them.
3. **Intermittent Pneumatic Compression Device:** This is a machine that has a pair of "booties" attached to your feet. The machine pumps air into these boots in a cyclic manner which helps to pump blood back to the general circulation and is used in patients who are too weak to start their exercises promptly or those patients who are going to be bedridden for a long time.

Pharmacological Means:

There are many prescription drugs in the world market that are used to prevent and treat deep venous thrombosis and pulmonary embolism used in patients undergoing hip or knee replacement surgery. These drugs act by enabling different chemical reactions of the coagulation cascade known

commonly as “blood thinners”. Their final goal is to prevent clot formation. Here we’ll show you a list of the most common medications used today for this purpose:

1. **Aspirin:** Aspirin is a commonly used medication that acts by directly inhibiting the function of platelets prolonging bleeding time though it doesn’t act directly over the coagulation cascade. Aspirin is commonly used to prevent the formation of clots inside arteries but it has **NO** effect on clots formed inside a person’s veins. Because aspirin has no effect on preventing clot formation inside veins it is **NEVER** used in the prevention of deep venous thrombosis and pulmonary embolism in patients undergoing major orthopaedic surgery. As a preventive measure we even discontinue the use of aspirin in patients at least 2 weeks before surgery because aspirin increases the risk of bleeding.
2. **Warfarin (Coumadin):** This is a highly effective anticoagulant drug, taken orally. This medication interferes directly with the production in the liver of certain chemicals that participate in the coagulation cascade and are vitamin K dependent. Warfarin starts to function 36 hours after the initial dose and takes from 4 to 5 days to reach peak function. It is somewhat difficult to determine the ideal dosage in each patient as it interacts with many different types of food and medications, therefore doctors have to closely monitor the effect of this drug with frequent lab tests. Too much effect and the patient can start bleeding, too little and the patient can suffer from clot formation.
3. **Heparin:** This is a naturally occurring substance in our body, being one of many natural regulators of the coagulation cascade. It is administered intravenously or subcutaneously but it also has to be monitored closely by frequent lab tests to prevent hemorrhagic complications. It can also induce something called heparin dependent thrombopenia , which is a serious complication.
4. **Low molecular weight heparins:** This is a group of semi-synthetic drugs derived from fractionated heparin. Thanks to this biochemical manipulation they are considered a very effective and safe medication for the prevention and treatment of deep venous thrombosis. Because they are quite safe, and have little or no interaction with food or other medications, there is no need to monitor its effects with lab tests. It is administered subcutaneously.

Postoperative Treatment:

The risk of developing a serious complication such as deep venous thrombosis and pulmonary embolism after major hip and knee replacement surgery can extend for as long as three months after surgery. The highest risk peaks from day 2 to day 5 after surgery, but there is also a high risk peak between day 10 and 14. This peak usually presents itself when the patient is recovering at home and before the first doctor’s visit after surgery.

At present , there exist different international guidelines for the prevention and treatment of deep venous thrombosis after major orthopaedic surgery

such as hip and knee arthroplasty. It is the responsibility of each doctor to follow this guidelines and choose the best medication, dosage, and timeframe for each patient. Remember that each patient is different so your doctor will choose what is best for you.

New antithrombotic agents:

Thanks to new advances in research and technology , large pharmaceutical companies are introducing into the world market a new set of drugs that help prevent and treat deep venous thrombosis. These new drugs promise to be safer and better than pre-existing drugs. The main advantages that can be seen over pre-existing drugs is that they can be administered orally once a day, they are safe, they don't need to be monitored by lab tests, they have no interactions with drugs or food, they have little or no side effects, they have very little bleeding complications, and they are more effective in preventing blood clot formation.

We would like to emphasize that even with the proper prophylactic protocol for the prevention of deep venous thrombosis, patients undergoing hip or knee reconstructive surgery are at a high risk of developing this serious complication. This complication is inherent in the type of surgery itself and in the previous medical condition of the patient.

If the patient does develop deep venous thrombosis or pulmonary embolism, your doctor will start immediate treatment and will need help from other specialists such as an internist, vascular surgeon, pneumologist, intensive care specialist etc.

Finally we would like to remind you by saying that every day that goes by the medical community has a better understanding of this serious complication and that "this silent enemy" can be defeated so that your hip or knee replacement surgery will have a low probability of presenting this adverse complication.

As always, if there are further questions, please let us know, and with pleasure we'll contact you and try to dispel your worries.

Remember we are here to help you.

Dr. Stefan Martínez van Gils & Dr. Isaac Cervantes.

NOTE: The main reason for the above information is to instruct patients. We will not be responsible for the decisions made by patients without previously consulting their attending physician.